NOTES ON THE BIOLOGY OF A RED SEA GOBY, *SILHOUETTEA AEGYPTIA* (CHABANAUD, 1933) (TELEOSTEI : GOBIIDAE)

by

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ABSTRACT.– *Silhouettea aegyptia* (Chabanaud, 1933) (= *Minictenogobiops sinaii* Goren, 1978) is a small, littoral gobiid fish occurring in the northern Red Sea, Suez Canal, and Bardawil Lagoon, Sinai. The species has been collected by the authors at Al-Ghardaqa and Ras Gemsa (Red Sea), and Lake Timsah (Suez Canal); it was present at Kabret, on the Bitter Lakes, by 1924. Living on sand, *S. aegyptia* has cryptic coloration and behaviour. Diet is chiefly harpacticoid copepods and nematodes. Maximum size (Lake Timsah) is about 5 cm, and longevity under two years. The species is gonochoristic, male genitalia showing typical gobiid sperm-duct glands but not an interstitial cell mass. External sexual dimorphism involves first dorsal finrays. Gonadosomatic index in females may reach at least 10 % with ripe oocyte diameter at least 0.64 mm and fecundity recorded at 305-405. Maturity is reached at less than one year old, at over 20-21 mm standard length. Breeding probably commences in May at Al-Ghardaqa, with repeat-spawning indicated by oocyte size-frequency distribution. Life-history pattern seems to relate to an epibenthic ecotope and should promote success as a Lessepsian migrant.

RÉSUMÉ.– *Silhouetta aegyptia* (Chabanaud, 1933 (= *Minictenogobiops sinaii* Goren, 1978) est un petit gobiidé littoral du nord de la Mer Rouge, du Canal de Suez et du lac Bardawil dans le Sinai. L'espèce a été capturée par les auteurs à Al-Ghardaqa et Ras Gemsa (Mer Rouge), et dans le lac Timsah (Canal de Suez); elle était présente à Kabret, dans les lacs salés, aux environs de l'an 1924. Vivant sur le sable, *S. aegyptia* possède une coloration et un comportement mimétique. Son régime alimentaire se compose surtout de copépodes harpacticoïdes et de nematodes. Sa taille maximum (dans le sac Timsah) est d'environ 5 cm et sa longévité de moins de deux ans. L'espèce est gonochorique, l'appareil génital mâle est formé par des glandes spermiductes caractéristiques des gobiidés mais est dépourvu de masse cellulaire interstitielle. Le dimorphisme sexuel externe ne concerne que les rayons de la première nageoire dorsale. L'indice gonadosomatique des femelles peut atteindre au moins 10 %, avec des ovocytes matures d'un diamètre d'au moins 0.64 mm et une fécondité comprise entre 305 et 405. La maturité sexuelle est atteinte à l'âge de moins d'un an, pour une taille supérieure à 20-21 cm. La reproduction commence en mai à Al-Ghardaqa, avec des pontes successives, mises en évidence par la distribution de fréquence des tailles des ovocytes. Le mode de vie, lié à un écotope épibenthique, devrait permettre à cette espèce d'être un migrateur à travers le Canal de Suez.

Keywords : Gobiidae, *Silhouetta aegyptia*, Red Sea, Suez Canal, cryptic coloration, cryptic behaviour, sexual dimorphism, fecundity, reproduction.

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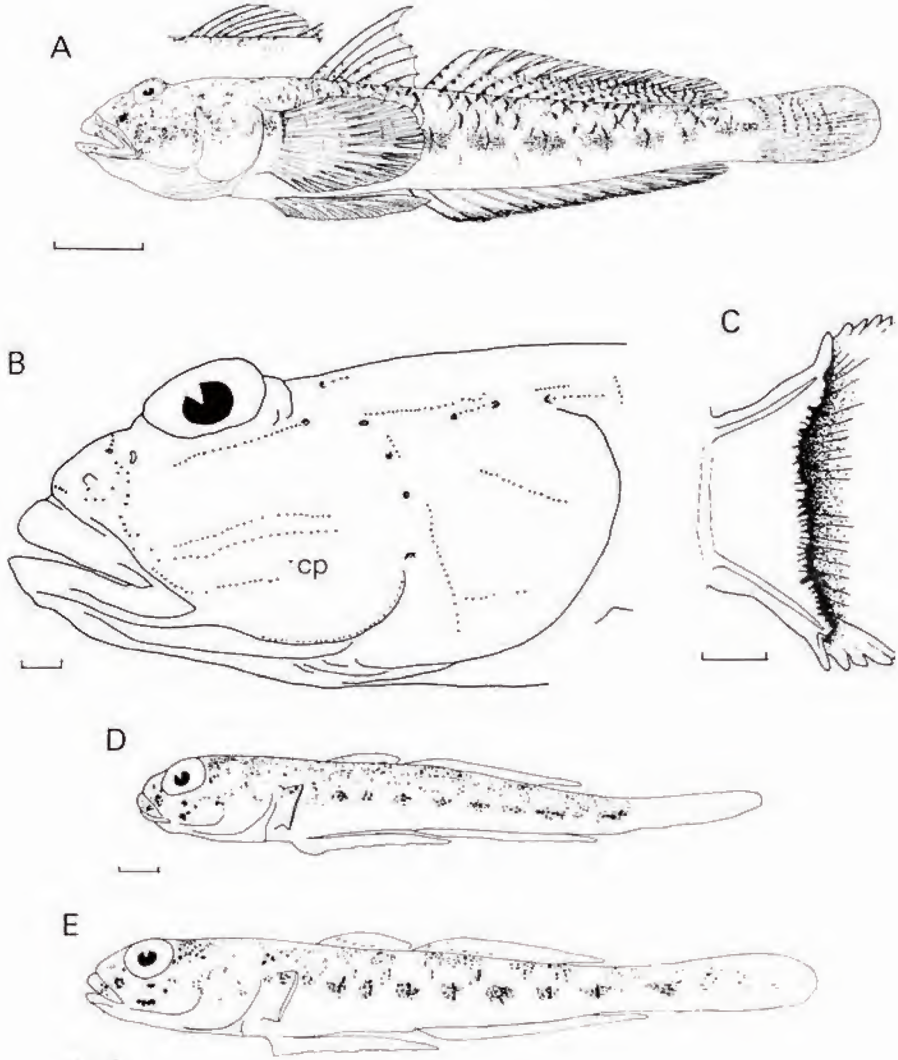

Fig. 1.–*Silhouettea aegyptia* (A) male, 39.5 + 8.5 mm, Lake Timsah; insert, D1 of female, 38.0 + 8.5 mm, Lake Timsah; (B) head lateral-line sensory papillae and canal pores, female, 31.5 + 8.0 mm, Al-Ghardaqa; (C) anterior pelvic membrane with villose edge, male, 34.5 + 9.0 mm, Al-Ghardaqa; (D) juvenile, 12.0 + 3.2 mm, Ras Gemsa; (E) juvenile, 14.5 + 3.8 mm, Ras Gemsah. Scale 5 mm (A), 1.0 mm (D, E), 0.5 mm (B, C).

During a visit to the northern Red Sea in spring 1977, the authors collected fish by fine-meshed seine-net in sandy shallows near the Oceanographic Institute at Al-Ghardaqa, Egypt. By far the most abundant bottom-dwelling species in the catches was a small goby, which, in size, coloration and habitat, was strongly reminiscent of an Atlantic-Mediterranean species, *Pomatoschistus microps* (Krøyer), the subject of a number of studies by the authors and colleagues summarised by Fouda (1978) and Miller (1984). In fact, rather than a zoogeographical surprise, the Ghardaqa goby proved to be a form originally determined by Chabanaud (1933) from Lake Timsah, on the Suez Canal, as a supposed subspecies – *aegyptius* – of the Mediterranean *Gobius lesueuri* (= *Lesueurigobius suerii* (Risso)), and could also be identified with a new genus and species, *Minictenogobiops sinaii*, recently described from Ras Muhamad and other Sinai localities (Goren, 1978, 1979). However, the Ghardaqa species is neither of Mediterranean origin or of a genus peculiar to the Red Sea, but, instead, seems referable to the Indo-Pacific *Silhouettea* Smith, 1959, based on *S. insinuans* Smith, 1959, from East Africa. A revision of *Silhouettea* by one of us (P.J.M., in preparation) will provide a full description of *S. aegyptia*, including new material from the type-locality. Distinguishing features of this species (Fig. 1A), which does not exceed 50 mm in total length, are, among sympatric gobies (Goren, 1979), those of the head lateral-line system, with longitudinal cheek papillae but row *cp* reduced to one papilla (Fig. 1B, the villose anterior pelvic membrane (Fig. 1C) and, in coloration, the sharply defined crescentic scale-edge markings which also transect the rhomboidal lateral midline blotches (Fig. 1A). These features of pigmentation are already becoming evident in juveniles at 12 - 14 mm standard length (Fig. 1 D,E). *Silhouettea* species are all recognisable by the possession of one or two more branched rays in the anal fin than in the second dorsal fin : in *S. aegyptia* counts are D2 1/10 (9-11) and A 1/11 (11-12).

Arising from primarily systematic work on *S. aegyptia*, the present paper is intended to summarise the known distribution of the species, from further collecting by the authors in the Gulf of Suez and the Suez Canal, as well as the findings of Goren (1979), and to provide some observations on the biology of this species, as sampled at Al-Ghardaqa, Ras Gemsah (Gulf of Suez), and Lake Timsah (Suez Canal). Among other species now placed in the genus, the biology of *S. dotui* (Takagi) (as *Ctenogobius dotui*), from Japan, has been investigated by Dotu (1958).

MATERIAL AND METHODS

Northern Red Sea : Al-Ghardaqa, Egypt (27°17'N, 33°47'E), 178 individuals, 13.5 - 34.5 mm standard length, 30 April and 1 May 1977 (P.J. Miller and M.M. Fouda). Gulf of Suez : Ras Gemsa, Egypt (27°39'N, 33°35'E), 144, 12.0 - 31.0 mm, 13 April 1980 (P.J. Miller and M.M. Fouda). Suez Canal : Kabret, Bitter Lakes, 4, 17.5 - 22.0 mm (Cambridge Expedition, 1924; BMNH uncat.) and NW Lake

Timsah, near Ismailia, Egypt (30°36'N, 32°15'E), 14, 22.0 - 39.0 mm, 11 May 1979 and 4 April 1980 (P.J. Miller). Eastern Mediterranean : Bardawil Lagoon, N. Sinai, Egypt (c. 31°N, 33°E), 3, 26.5 - 30.5 mm, 11 April 1972 (A. Ben-Tuvia).

Material collected by the authors was obtained by means of fine-meshed (mosquito netting) seine-nets, 2 - 4 m long, hauled in shallows. Salinity estimates were made with a small hydrometer, thermometer, and Harvey's (1945) nomograph, an old but expedient combination. After preservation in 5 % formaldehyde solution, specimens were dissected under low power binocular microscope for removal of gut and gonads. The carcass was then cleared in 1 % potassium hydroxide solution and stained with alizarin-red S prior to scale inspection and examination of fin-rays. The latter were detached and measured against a stage graduated scale.

DISTRIBUTION

Localities at which *S. aegyptia* is recorded are shown in Fig. 2. To date, the species appears to be restricted to the northern Red Sea, Gulfs of Suez and Aqaba, Suez Canal and Bardawil Lagoon, on the Mediterranean coast of Sinai. Despite some collecting, *S. aegyptia* has not been found in the southern part of the Red Sea (Goren, 1979) or in collections of gobies from Somalia (Miller, unpublished) or East Africa (Smith, 1959). The probably widespread distribution of *S. aegyptia* in normal marine habitats of the northern Red Sea would suggest that it belongs to the endemic biota characterising the northerly, more saline but cooler waters of this basin (Por, 1978). In the Suez Canal, the species has been present since at least the time of the Cambridge Expedition (1924), being represented among gobies identified as *Gobius ocheticus* by Norman (1927) (see material). How *S. aegyptia* entered Bardawil Lagoon is not known. This shallow hypersaline lagoon is now connected to the Mediterranean and, in the past, was connected with Lake Menzalah of the Nile Delta (Por, 1978). The presence of *S. aegyptia* seems more likely to denote an initial phase of Lessepsian immigration, rather than survival of an Isthmus species, as discussed by Por (1978) and for another Suez Canal goby, *Monishia ochetica*, by Miller (1978). Occurrence along the open coastline of the Mediterranean, eastwards from Port Said to Israel, has not been established (Ben-Tuvia, 1971 ; Por, 1978).

HABITAT

At Al-Ghardaqa and Ras Gemsa, the species was found to be common on sand or sand-covered dead coral from the edge of the sea to about 0.5 m depth, and seems to be the most abundant epibenthic fish in what initially appears, through the clear water, to be a barren habitat. In Lake Timsah, *S. aegyptia* was taken on substrates from sand to gravel with an *Ulva*-like green seaweed, but, at this locality, was greatly outnumbered by the small Mediterranean goby, *Pomatoschistus marmo-*

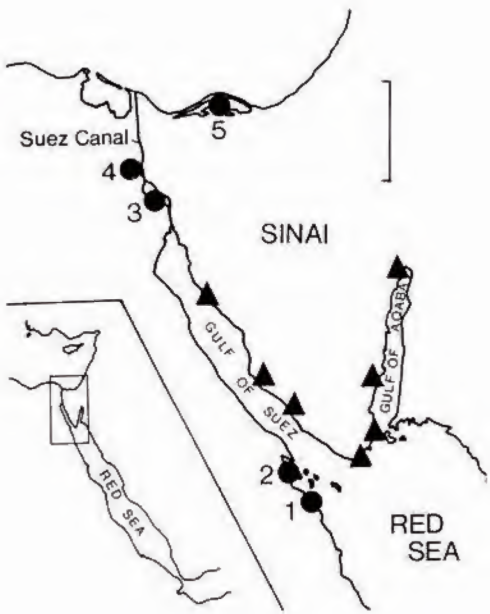

Fig. 2.- Geographical distribution of *Silhouettea aegyptia*. Circles : material examined by authors from (1) Al-Ghardaqa, (2) Ras Gemsa, (3) Kabret, (4) Lake Timsah, and (5) Bardawil Lagoon ; triangles : localities listed by Goren (1979) (as records for *Minictenogobiops sinaii*). Scale 100 km.

ratus (Risso). Under the marine conditions of Al-Ghardaqa and Ras Gemsa, *S. aegyptia* inhabited water of salinity exceeding 40‰. However, somewhat less saline and presumably more variable conditions must be tolerated in Lake Timsah. At the same beach in the north-western corner of the lake, salinity was 23-25‰ on 1 May 1979 but 36.5-38‰ on 4 April 1980. Occurrence in Bardawil Lagoon could be interpreted as further evidence that the species is sufficiently euryhaline to have traversed the Suez Canal.

Although *S. insinuans*, from East Africa, was reported by Smith (1959) to burrow in sand, *S. aegyptia* was caught in numbers by a light seine net which caused little disturbance to the substrate. However, for temporary concealment, this species can bury itself to eye level in the sand by rapid body and pectoral fin movement (Fig. 3). The relatively high situation of the eyes, somewhat compressed body, and lengthened post-anal region, may be correlated with this practice. A similar behaviour pattern has been noted by Dotu (1958) for *S. dotui* and by Bruton and Kok (1980) for the freshwater *S. sibayi* of Maputaland, when, in the latter species, accompanying movements of the very elongate first dorsal fin are believed to attract prey.

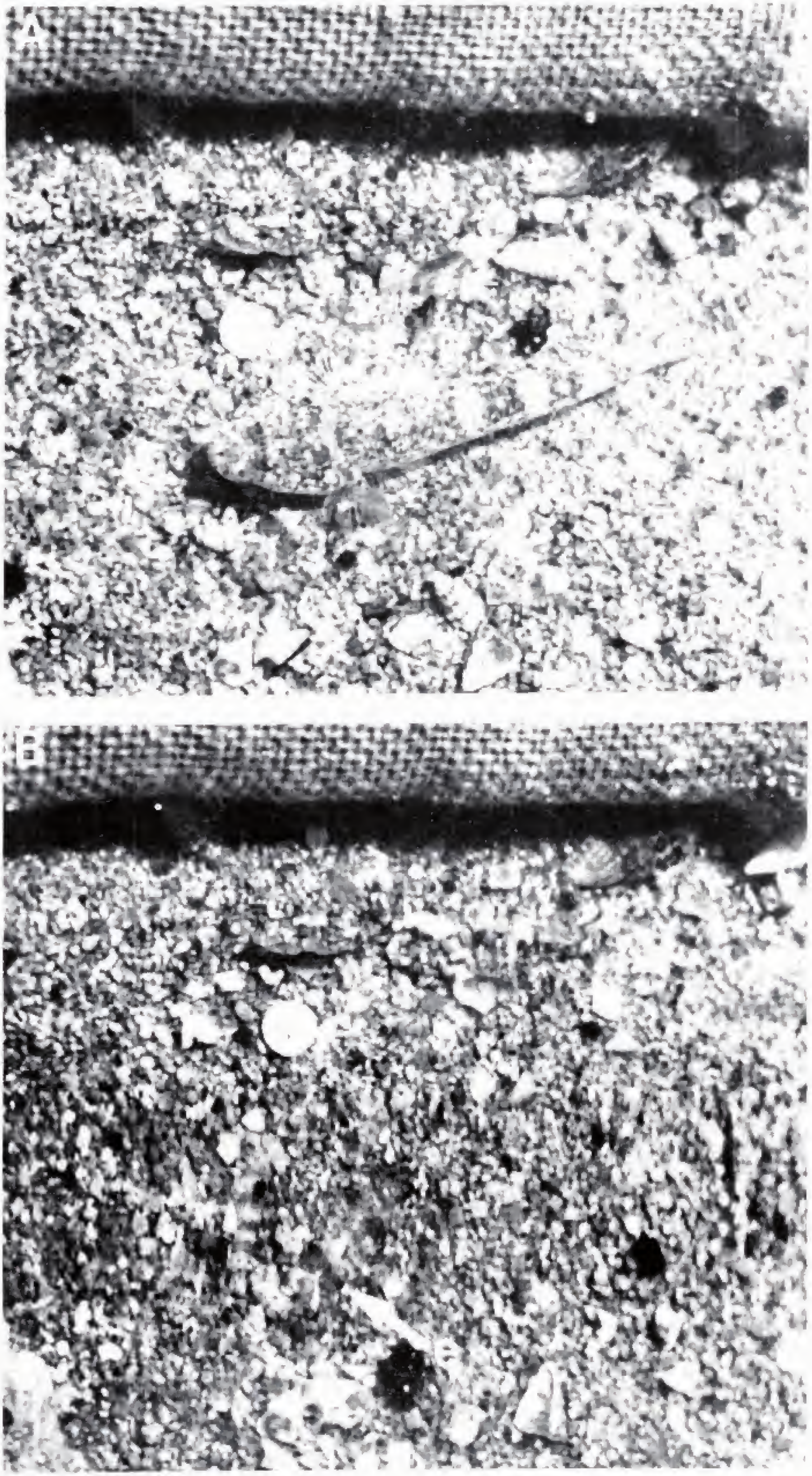

Fig. 3.– *Silhouettea aegyptia.* (A) Resting on surface of sand substrate and (B) buried to eyes

FOOD

The stomachs of fifty individuals were opened, 41 of these containing ingested material. Food organisms have been recorded (Table I; Fig. 4) by number of individual items, frequency of occurrence within the sample of fishes, and volumetric comparison using a 'point' system (Hyslop, 1980). *Silhouettea aegyptia* appears to be almost exclusively a bottom-feeder, preying on meiobenthos, with most fish having also ingested quantities of sand. The predominant food organisms, in both number and occurrence, were harpacticoid copepods, with free-living nematodes occurring in the same high percentage of stomachs but not as abundantly. Both invertebrate groups are major constituents of the meiofauna of tropical sandy beaches (McIntype, 1968). It has proved impracticable to attempt further identification of the harpacticoid copepods found but determination of the nematodes to family level has shown that the most numerous were monoposthiids, followed by spirinids and oxystomatids, with occasional chromadorids, cyatholaimids, monhysterids, and oncholaimids. Other small benthos eaten in any quantity comprised oligochaetes and gastropods. Among the remainder, the cumaceans were all adult male *Cyclaspis* sp, more active swimmers than females and juveniles which are less likely to emerge from their burrows (N.S. Jones, pers. comm.).

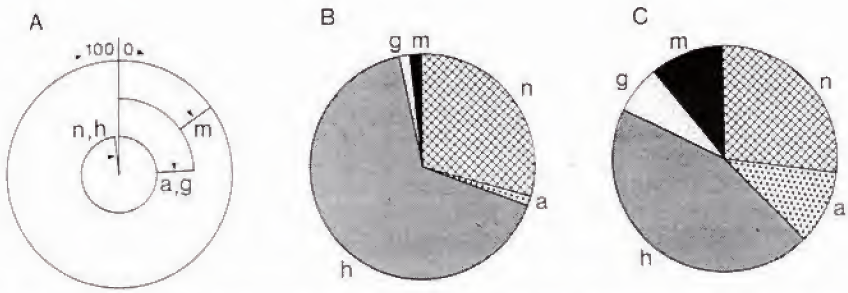

Fig. 4.–Food composition (percentage) for *Silhouettea aegyptia* by (A), frequency of occurrence, (B), number of items, and (C), points (see text); a, annelids; g, gastropods; h, harpacticoid copepods; m, miscellaneous; n, nematodes.

SIZE

For the Red Sea localities, maximum lengths recorded were 34.5 + 9.0 mm (male) and 34.0 + 9.0 mm (female), both from Al-Ghardaqa. From Lake Timsah, larger fish were obtained, up to 39.5 + 9.6 mm (male) and 38.5 + 9.3 mm (female). Increase in size appears isometric : a standard length (L_S, mm) : total weight (W_t g) relationship determined for 46 individuals, 17.5-34.5 mm, preserved in 5 % formalin, was expressed by

$$W_t = 0.0000169\ L_S^{\ 3.00844}$$

Table I.– Stomach contents of *Silhouettea aegyptia.*

	No. of items		Fréquency of occurrence		Points	
Stomach contents	N	%	Nf	% *	Np	% +
Nematoda (see text)	503	29.5	40	98.0	89.0	27.2
Annelida						
Polychaeta	1	<.1	1	2.4	1.0	0.3
Oligochaeta	21	1.2	10	24.4	34.0	10.4
Crustacea						
Ostracoda	3	0.2	2	4.8	1.0	0.3
Copepoda						
Harpacticoidea	1126	66.1	40	98.0	144.5	44.2
Decapoda						
Cumacea (*Cyclaspis* sp.)	6	0.4	5	12.2	9.5	2.9
'Caridioid'	1	<.1	1	2.4	1.0	0.3
Brachyura	1	<.1	1	2.4	0.5	0.2
Indet.	6	0.4	4	9.8	6.5	2.0
Arachnida						
Hydracarina (*Copidognathus* sp.)	3	0.2	2	4.8	1.0	0.3
Mollusca						
Gastropoda	23	1.4	10	24.4	22.5	6.9
Bivalvia	1	<.1	1	2.4	0.5	0.2
Algae						
'filaments'	1	<.1	1	2.4	1.0	0.3
Indet.	7	0.4	7	17.1	1.5	4.6
Sand	NR	–	37	90.2	90.2	–

*, percentage of fishes (n = 41) with ingested material in stomach ;
+, percentage of total points for food organisms; 'points' method of assessment noted in text; Nf, Np, number of fish and points respectively; NR, not recorded; note that percentages are to nearest first place of of decimal.

AGE-COMPOSITION

(a) *Size-frequency distributions* for the Al-Ghardaqa, Ras Gemsa and Timsah collections are shown in Fig. 5. For the two large samples (Fig. 5A, B), histogram pattern resembles that dispayed by the mostly single year-class breeding season populations of the short-lived temperate species, *Pomatoschistus microps* (Miller, 1975 ; Fouda & Miller, 1981). Here too, a shallow bimodality seems to be a feature of size distribution within a single year-class and scale inspection (see below) does not support the suggestion of two age-groups.

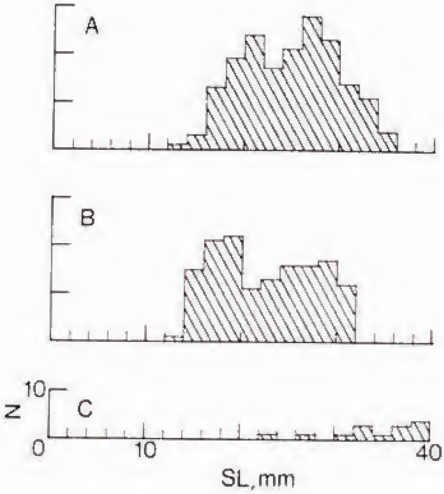

Fig. 5.– Length-frequency distribution of *Silhouettea aegyptia* from (A) Al-Ghardaqa, (B) Ras Gemsa, and (C) Lake Timsah. N, number of fish ; SL, standard length, in 2 mm length-groups.

(b) *Scale examination.* Scales were removed from the caudal peduncle and examined after alizarin-staining. In common with many other gobies (Miller, 1973), the ctenoid scales of *S. aegyptia* carry uniserial ctenii along the rear edge of the scale ; scanning electron microscopy has also revealed the presence of scalar denticulation along the edges of the circuli, as described in *P. microps* by Fouda (1979). In comparison with *P. microps* (Miller, 1975 ; Fouda, 1979), circuli are more close set and zones of narrowing less easily noticed. Examination of scales from Al-Ghardaqa failed to reveal noticeable annuli, but the scales of most of the Timsah specimens showed a usually indistinct annulus and narrow sclerites inside the growing edge of the scale. This was nearer the edge in the April (1980) fish than in those collected in May (1979), presumably after a longer period of spring growth in the latter sample. The annulus observed is comparable to the first spring annulus of *P. microps* (Miller, 1975).

(c) From the above evidence, it would seem that *S. aegyptia* is a short-lived species, with no evidence for survival beyond a second year of life. In the absence of metamorphosing postlarvae, which the fine-meshed seine net could have retained, the age-group present in the various samples appears to be that of the previous year, and the wide size-ranges (Fig. 5) attributable to a long spawning period within the year (see below).

REPRODUCTION

(a) *Mode.* Sex distribution with body length (Fig. 6) for 51 Al-Ghardaqa individuals, whose gonads were examined by dissection, and 12 Timsah fish, sexed by urogenital papilla, indicates that *S. aegyptia* is gonochoristic, with males and fe-

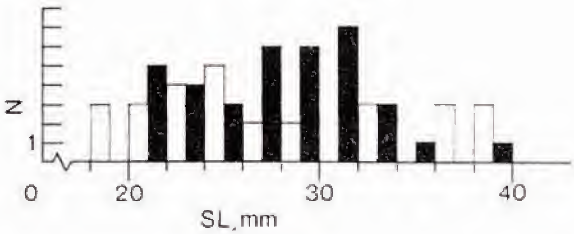

Fig. 6.– Length-frequency distribution of *Silhouettea aegyptia* by sex for Al-Ghardaqa and Timsah material. Open column, males ; black column, females ; N, number of fish ; SL, standard length, in 2 mm length groups.

males occurring together over virtually the entire range in body size. In the larger sample, from Al-Ghardaqa, a preponderance of females (31) to males (20) may be due to selective capture of females in the breeding season, as seen in other epibenthic gobies, when at least larger, sexually mature males may be occupying nests under shelter (Miller, 1984).

(b) *Genitalia*. In study of the Al-Ghardaqa sample, it has been possible to recognise stages in gonad maturation, from immature to late- ripening ovaries or testes with sperm (basic classification by Miller, 1961). The male genitalia in gobiid fishes is characterised by the possession of sperm duct glands, the so-called 'seminal vesicles' (Miller, 1984). In *S. aegyptia*, the immature testis (Fig. 7,A) is elongate, with the contiguous sperm duct gland only slightly protuberant. With maturation

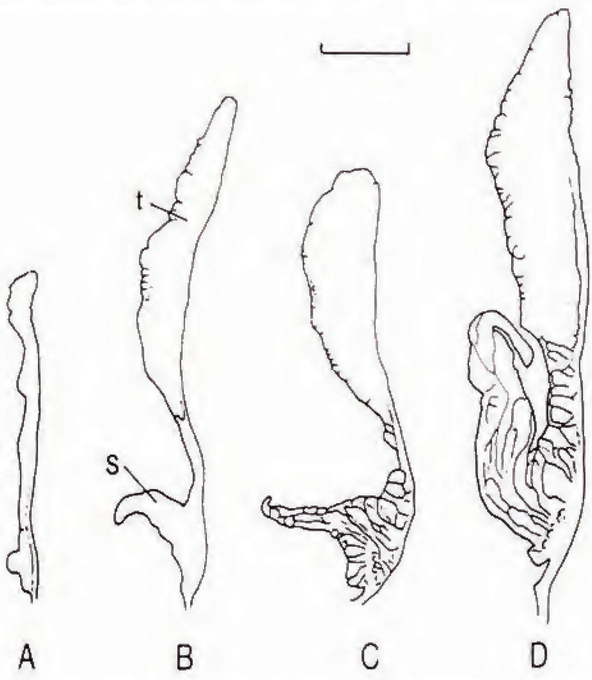

Fig. 7.– Testis (t) and sperm duct gland (s) in male *Silhouettea aegyptia* from Al-Ghardaqa ; (A), immature, SL 19.5 mm, (8), developing, SL 29.0 mm, (C) ripening, SL 27.0 mm, and (D), ripe, SL 32.5 mm. Scale 1 mm.

(Fig. 7, B-D), the testis broadens and the lobules of the sperm duct gland become distended, the more caudal greatly produced into an attenuate lappet extending forwards within the abdominal cavity. Transverse sections (at 10μ, haematoxylin and eosin) through the mature testis revealed no major aggregation of interstitial tissue, as found in the testes of other gobiid species (Miller, 1984). The ovary of *S. aegyptia* is of the usual cystovarian type ; although late ripening stages were found, no ovary contained ripe oocytes.

The long pelvic disc of this species, covering anal and urogenital orifices, obstructs easy sex determination by external examination of the urogenital papilla (Egami, 1960 ; Miller, 1961 ; Arai, 1964). The urogenital papilla in *S. aegyptia* differs in shape between the sexes, that of the males being slender even in larger individuals examined. Takagi (1957) has illustrated the urogenital papillae of *S. dotui*, Egami (1960) classifying these as belonging to type B among gobioid fishes.

Table II.– Fin-ray lengths (% standard length) for first and second dorsal, and anal, fins in *Silhouttea aegyptia* more than 25.0 mm in standard length, from Al-Ghardaqa.

Sex	Males				Females			
	N	R	X	SD	N	R	X	SD
First dorsal :								
I	10	16.0-23.2	20.0	2.23	29	11.9-15.8	13.7	1.09
II	10	14.8-17.4	16.3	0.95	29	13.1-16.5	14.7	0.88
III	10	11.9-15.9	14.3	1.20	29	12.5-16.8	14.6	0.89
IV	10	11.1-13.5	12.6	0.92	29	12.1-16.1	14.1	0.93
V	10	9.0-13.5	11.1	1.20	28	9.5-14.5	12.8	1.33
VI	10	5.2-10.7	6.6	1.55	27	6.0-10.2	8.2	1.05
Second dorsal :								
I	9	10.2-12.2	11.1	0.79	9	11.1-12.7	11.9	0.56
1	8	12.3-16.0	14.5	1.23	9	13.2-15.2	14.3	0.69
5	8	14.5-17.6	16.1	1.10	9	12.7-14.6	13.4	0.65
pen.	9	14.8-19.1	17.8	1.43	9	11.1-13.1	12.2	0.63
ult.	9	12.4-17.4	15.3	1.57	9	8.7-10.5	9.7	0.59
Anal :								
I	7	7.7-10.2	9.4	0.87	9	8.2-10.2	9.3	0.56
1	5	11.0-13.1	12.0	0.90	9	10.9-13.0	12.2	0.68
5	8	12.2-14.0	13.0	0.63	9	11.3-13.4	12.4	0.61
pen.	8	13.1-16.0	14.2	0.96	9	11.8-14.0	12.9	0.60
ult.	8	11.4-15.6	12.1	1.42	9	10.2-11.8	10.9	0.44

Spinous rays in roman, articulated rays in arabic, numerals ; pen., penultimate, and ult., last rays of second dorsal and anal fins. Values are N, number of observation; R, range ; X, mean; and SD, standard deviation.

(c) *Sexual dimorphism.* Although adults differ in intensity of coloration, most obvious sexual dimorphism is in relative growth of the first dorsal fin rays, and in the rear rays of the second dorsal and anal fins (Table II). In adult males, D1 I is much longer than in females and is the longest ray of the high triangular fin, with D1 II less elongate. In females, D1 III is longest and comparable in relative length to that of males, but D1 IV, V and VI, although shorter than D1 III, are somewhat longer than D1 IV-VI of males, so that the first dorsal fin of females is lower but convex in outline. The second dorsal fin and anal fin in adult males have longer posterior rays, apparent in more elongate rear tips to these fins.

(d) *Reproduction effort.* The ovaries of four Al-Ghardaqa females (standard lengths 27-32.5 mm) were found to be at the late ripening stage. These ovaries, the most advanced in all the material encountered, including the larger females from Lake Timsah, comprised 8.15 - 9.83 % of body weight, excluding gonads but including food-containing gut. These values are lower than average among gobiid species investigated (Miller, 1984), but should become somewhat higher in completely ripe fish, probably between 10-15 %.

(e) *Length and age at maturity.* The smallest male with incipient gonad development was 21.5 mm (SL), while examples of 22.5 mm displayed later ripening testes ; among females, beginning of vitellogenesis (II) was found at 20 mm, early ripening (IIIa) from 25.5 mm, and late ripening from 27 mm. At body length from 20-21 mm, onset of differential growth between the sexes in the first ray of the first dorsal fin (D1 I), is also apparent (Fig. 8). Age at maturity is unlikely to exceed one year.

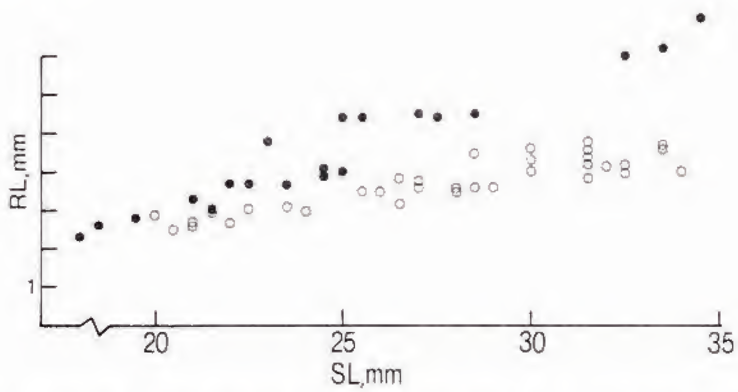

Fig. 8.– Relation between length of first ray of first dorsal fin (RL) and standard length (SL) in male (black circles) and female (open circles) *Silhouettea aegyptia*, from Al-Ghardaqa.

(f) *Number of broods.* The late ripening ovaries possessed two groups of oocytes undergoing vitellogenesis, a larger batch of 0.5-0.64 mm diameter and a second group of 0.18-0.28 mm. This situation is typical for gobies as repeat-spawners within a long breeding season, and may indicate a capacity for the production of many broods (Miller, 1984).

(g) *Bestowal and fecundity*. The largest late ripening oocytes found, at 0.5-0.64 mm in diameter, were estimated to represent a modal yolk volume of 0.097 mm^3. When somewhat larger in the ripe state, yolk volume in *S. aegyptia* should be about average for marine gobies at that body size (Miller, 1984, Fig. 6). As found the oocytes were already larger than those in the ripe condition of *S. dotui* (Dotu, 1958 ; Miller, 1984). Counts of late ripening oocytes made in four females were 305 at standard length 27.0 mm, 408 at 28.5 mm, 406 at 32.0 mm and 404 at 32.5 mm. Perhaps in keeping with smaller eggs, *S. dotui* can have 880 at about 31 mm standard length (Dotu, 1958).

(h) *Maturity stages and breeding season*. Maturity stages were determined by dissection for the gonads of 50 individuals, and are shown with reference to size of fish in Table III. The occurrence of late ripening (IIIb), but not ripe (IV), females suggests that breeding at Ghardaqa may begin during May, indicating a reproductive seasonality appropriate to the annual sea temperature cycle in the northern Red Sea (Abel, 1960). With evidence for repeat-spawning (see above), the breeding season probably last some months. In southern Japan (Ariake Sound), *S. dotui* breeds all summer (Dotu, 1958). No fertilised eggs were found for *S. aegyptia* but Dotu (1958) notes that *S. dotui* spawns on the inner surface of bivalve shells.

Table III.– Occurrence of gonad maturity stages among size-groups of *Silhouettea aegyptia*, collected on 30 April and 1 May 1977, at Al-Ghardaqa.

Sex	Males			Females		
Gonad maturity stages	I	II	III & IV	I	II	III
Size-range of fishes (standard length, mm)						
10.0 - 19.5	3	–	–	–	–	–
20.0 - 21.5	1	2	–	–	4	–
22.0 - 23.5	1	–	3	3	1	–
24.0 - 25.5	–	4	1	1	1	–
26.0 - 32.5	–	–	5	–	10	10

Gonad maturity stages as defined by Miller (1961) and present text.

DISCUSSION

In ecotope, *S. aegyptia* is an epibenthic predator on the superficial meiofauna. The ability to exploit free-living nematodes as an important food resource, as well as the harpacticoid copepods often eaten by small species of fish, may be a dietary feature of special significance. Small body-size, related to the efficient use of tiny prey organisms, may incur a high risk of predation by larger animals in an open

habitat (Miller, 1979). The cryptic coloration and behaviour shown in Fig. 3 must serve to counter this threat for the individual. In life-history, the early maturation and short life-span indicated for this species can also be interpreted as aspects of an adaptive response to such a stochastic pattern of mortality (Miller, 1984). Appropriately, examination of available gonad stages suggest what might be a substantial primary reproductive effort, if gonadosomatic index is multiplied by repeat spawning. Such life history features characterise opportunistic species which make successful colonists of new habitats, exemplified in this case by the Suez Canal.

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